BRANDON AMMONIA STUDY NO. 3
AMBIENT AMMONIA MONITORING
BY THE MOBILE MONITORING UNIT
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by

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Abstract

As part of a continuing monitoring program for ammonia in air in the Brandon area, the Mobile Monitoring Unit was mobilized during February 1983 to monitor ambient ammonia levels in and around the Brandon Industrial Park. Two operations, Simplot Chemical Company Ltd. and Ayerst Organics Ltd., were examined to determine singular and cumulative emission levels in the vicinity of the two plants.

Results from this study indicate that elevated ammonia levels persist within the Simplot plume, whereas levels of ammonia in the Ayerst plume were at trace concentrations.

Introduction

As part of a continuing monitoring program for ammonia in air in the Brandon area, and at the request of the Air Pollution Control Section of Environmental Control Services, a third study was undertaken by the Mobile Monitoring Unit to monitor ambient ammonia levels in and around the Brandon Industrial Park.

Two objectives were delineated for this study:

1. To measure ammonia levels in the plume from Simplot Chemicals;
2. To assess if any ammonia is present in the plume from Ayerst Organics, and if so, to evaluate the impact on results observed from Simplot.

The surveys for this study were performed on February 1-3 and February 22-25, 1983, respectively, with sampling being undertaken as meteorological conditions permitted, and access to affected areas allowed. This report contains the results of the aforementioned study.

Procedures

Using meteorological data, and visual observation to determine direction of plume travel, a sampling site was picked adjacent to the company to be monitored. The Mobile Monitoring Unit (MMU) was set up in this position, and the sampling manifold was attached, allowing a sample to be obtained approximately three and one-half metres above ground level.

Analysis was achieved using a TGM555 automated colorimetric analyzer with ammonia module installed. Ammonia present in the air sample is converted to ammonium ion in the presence of a dilute solution of sulfuric acid (0.1N). The ammonium ion in solution reacts with sodium salicylate solution in the presence of sodium hypochlorite to produce an intense, emerald green color, which is measured by the colorimeter. The results were compared to a calibration curve prepared prior to the survey to determine actual ammonia concentrations. This method is highly specific for ammonia, with few interferences.

A number of problems exist which are intrinsic to the mobile monitoring process itself. In some cases, access to areas affected by emissions from a plant is extremely limited, thus hampering monitoring

operations, as representative samples cannot be obtained. Adverse meteorological conditions are also found to severely affect the sampling process. Automated, overnight sampling at one location is found to generate little meaningful data, unless the MMU is frequently checked, as wind conditions may vary over a long monitoring period. At these times during a survey data obtained is limited, and in most cases, represents background concentrations of the compound being analysed. Background levels are noted in the text of the discussion section.

Results were calculated on the basis of a one hour time-weighted average (TWA). The TWA in this study is defined as the observed sample concentrations averaged over a one hour sampling period.

Results

AMBIENT AMMONIA LEVELS WITHIN THE BRANDON INDUSTRIAL PARK

Date & Time	Place	Ammonia in Air 1 Hour TWA (ppm)	Concentration Peak (ppm)	Comments
Feb. 2/83 2:36-3:36	Inventronics Ltd. property (25 m Southwest of Ayerst plant)	0.11	0.15	Wind N-NE light and variable; faint urea odour
Feb. 2/83 4:18-5:18	Van Horne Ave. East across from Ayerst (15 m North)	0.13	0.19	Wind S-SE moderate;urea odour strong; faint sweet odour.
Feb. 3/83 12:00-1:00	Inventronics Ltd. property (25 m Southwest of Ayerst plant)	0.23	0.37	Wind N-NE light and shifting - Ayerst plume overhead; urea odour.
Feb. 3/83 1:00-2:00	Inventronics Ltd. property	0.51	1.40	Wind shift E-SE; Ayerst plume blowing away from sampling position.
Feb. 3/83 2:20-3:20	Douglas Street	0.13	0.32	Wind E-NE light and variable; almost vertical dispersion; no detectable odours.
Feb. 3/83 4:45-5:45	Assiniboine Community College	0.25	0.45	Wind SE - light; no detectable odours.

Feb. 23/83 9:45-10:45	17th Street East between railway crossings (Southwest of Simplot)	3.75	6.20	Wind N-NE moderate and shifting; ammonia odour pervasive.
Feb. 23/83 2:50-3:50	Richmond Avenue due south of Simplot plant	1.94	5.85	Wind N-NE moderate and shifting; ammonia odour physically detectable but not as strong as morning.
Feb. 24/83 10:10-11:10	Van Horne Avenue due North of Ayerst plant	4.26	7.45	Wind from S-SE moderate to strong; ammonia and solvent odours all present. Simplot plume blowing over Ayerst plant.
Feb. 24/83 12:45-1:45	17th Street E. between Simplot and Ayerst plants	1.12	3.3	Wind S blowing Simplot plume E of MMU position wind light; faint ammonia odour noted.
Feb. 24/83 2:00-3:00	Van Horne due North of Ayerst plant	0.45	1.10	Wind S-SE light; urea and solvent odours strong.
Feb. 25/83 9:20-10:20	Van Horne Avenue East North of Ayerst plant.	0.20	0.35	Wind S strong & gusting; urea and solvent odours strong in area; no detectable ammonia odour.
Feb. 25/83 1:55-2:55	Van Horne Avenue East North of Ayerst plant	<0.10	0.15	Wind S strong and gusting; urea and solvent odours pervade area; no detectable ammonia odour.

Observations

Monitoring was hampered during the period of February 1-4 by unsuitable meteorological conditions. Winds were light near ground level with almost vertical dispersion for most of the survey. Winds stratified at higher altitudes carried the Simplot plume into the upper atmosphere, such that no ground impingement was found to occur in the proximity of the plant. The plume from Ayerst Organics was found to move approximately 10 metres above ground, and to disperse within approximately 100 meters of the plant. The smell of the Ayerst plume was highly distinctive, with a strong urea odour and a fainter sweet odour (no ammonia odour could be detected). The sweet odour could be due to the solvents used in Ayerst purification and extraction process (toluene, ether and hexanol).

Meteorology for the second survey (February 22-25) was almost exactly opposite to that observed in the first. Moderate to strong breezes and a probable inversion in the upper atmosphere caused almost constant impingement around the Simplot plant during the mornings and part of the afternoons, obscuring visibility around the plant and producing physically discernable ammonia odour in the area of the plume. Movement of the Ayerst plume was found to occur in roughly the same fashion as in the first survey. However wind velocities at ground level were found to be much higher.

Discussion

The surveys described in the previous sections are not comprehensive, and should not be considered as such. However, some conclusions can be drawn from the data obtained. First, meteorology in the Brandon area plays an important part in determining ammonia levels observed within and surrounding the Brandon Industrial Park. Observations made on-site indicate that the meteorological conditions can affect whether a plume is dispersed into the upper atmosphere or trapped and carried down to impinge at ground level. This is especially noteworthy in the case of the Simplot plume, where mostly vertical dispersion was observed in the first survey, while almost constant impingement and fumigation of the surrounding area was observed during the second survey. The behaviour of emissions from Ayerst Organics was not found to be greatly affected by meteorological conditions, due to the small plume size.

The second conclusion that can be drawn from this study concerns ammonia emissions from Simplot. When monitoring in the vicinity of the Simplot plume, ammonia concentrations approaching or exceeding the Manitoba ambient air quality guideline of 2 ppm averaged over a one hour period were observed in nearly all cases. The pungent odour characteristic of ammonia could also be physically detected in the areas surrounding the Mobile Monitoring Unit, in degrees ranging from very faint, to strong with mild nose and throat irritation. It should be noted that, in most cases, these concentrations can be directly attributable to emissions from Simplot, as the choice of monitoring site coupled with the direction of the wind, precluded sampling plumes from other industrial operations which could affect the monitoring. Background ammonia concentrations in the Brandon area were found to be less than 0.1 ppm, averaged over a one hour period.

The third conclusion that can be drawn from this study is that very little ammonia is being emitted from the Ayerst Organics plant. The process used to produce estrogen for birth control pills from pregnant mare's urine involves extraction and condensation with no

chemical reaction taking place. Therefore, the only source of ammonia production at this facility would be from urine which has become "stale" while in storage, decomposing to produce ammonia and other organic by-products. Results, based on a one hour time weighted average (TWA), ranged from 0.25 ppm down to less than 0.1 ppm, which is the detection limit of the instrument.

The data obtained during this study may be broken down into three separate categories: results attributable directly to emissions from Simplot Chemical or Ayerst Organics, and data which represents a cumulative emission from both plants. Readings in the third category represent times during the study when meteorological conditions caused the Simplot plume to blow directly over the Ayerst plant, or allowed ground impingement to take place, dispersing the plume over a wide area. Results obtained on February 24, 1983 at 10:10 - 11:00 a.m. and 2:00 - 3:00 p.m., fall into this category.

It appears that the Ayerst Organics operation has very little impact on ammonia levels observed in the Brandon Industrial Park, as the values observed from Ayerst are relatively insignificant compared to those observed from Simplot Chemical. The data obtained from Ayerst also represents a seasonal output, as the Ayerst plant is only in operation from October to March of each year.

Bibliography

1) Bawden, G., Ambient Air Levels of Ammonia In The City of Brandon, Mobile Monitoring Unit Study 82-1, Province of Manitoba, Environmental Management Division, 1982.

2) Bawden, G., Ammonia Monitoring In Brandon By The Mobile Monitoring Unit, Mobile Monitoring Unit Study 82-2, Province of Manitoba, Environmental Management Division, 1982.

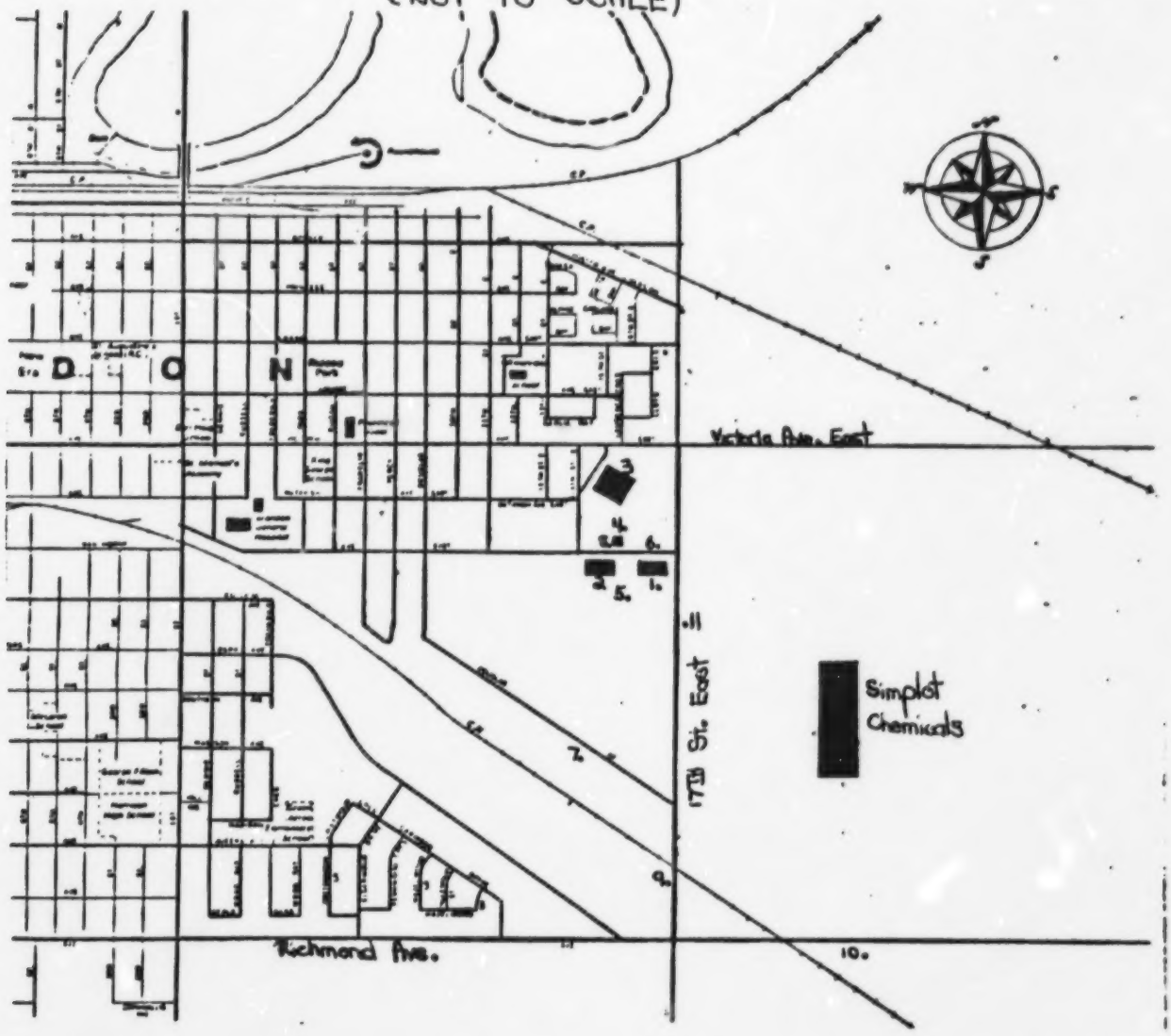
APPENDIX

BRANDON AMMONIA STUDY NO. 3

MAP OF MONITORING LOCATIONS

MAP OF BRANDON INDUSTRIAL PARK LISTING MMU MONITORING LOCATIONS

(NOT TO SCALE)



Legend

1. Ayerst Organics Ltd.
2. Inwentronics Ltd.
3. Assiniboine Community College
4. Sampling Station #5131

Monitoring Sites

5. Feb 2/83 2:36-3:36, Feb. 3/83 12:00-2:00,
6. Feb 2/83 4:18-5:18, Feb 24/83 10:10-11:10, 2:00-3:00, Feb 25/83 9:20-10:20 1:55-2:55
7. Feb 3/83 2:20-3:20
8. Feb 9/83 4:45-5:45
10. Feb 23/83 2:50-3:50
11. Feb 24/83 12:45-1:45

POOR

QUALITY

ORIGINAL